

## **Supplemental Material**

# **Seafood, wine, rice, vegetables, and other food items associated with mercury biomarkers among seafood and non-seafood consumers: NHANES 2011-2012**

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**Supplemental Table 1. Classification of USDA/WWEIA food categories into food groups**

<b>Food group</b>	<b>USDA/WWEIA food category</b>
Milk and flavored milk	Milk, whole (1002); milk, reduced fat (1004); milk, lowfat (1006); milk, nonfat (1008); flavored milk, whole (1202); flavored milk, reduced fat (1204); flavored milk, lowfat (1206); flavored milk, nonfat (1208); milk shakes and other dairy drinks (1402)
Cheese and yogurt	Cheese (1602); cottage/ricotta cheese (1604); yogurt, whole and reduced fat (1802); yogurt, lowfat and nonfat (1804)
Beef, poultry, meats	Beef, excludes ground (2002); ground beef (2004); pork (2006); lamb, goat, game (2008); liver and organ meats (2010); chicken, whole pieces (2202); chicken patties, nuggets and tenders (2204); turkey, duck, other poultry (2206); cold cuts and cured meats (2602); bacon (2604); frankfurters (2606); sausages (2608)
Fish	Fish (2402)
Shellfish	Shellfish (2404)
Beans, nuts, soy	Beans, peas, legumes (2802); nuts and seeds (2804); processed soy products (2806); milk substitutes (1404)
Meat (mixed dishes)	Meat mixed dishes (3002)
Poultry (mixed dishes)	Poultry mixed dishes (3004)
Seafood (mixed dishes)	Seafood mixed dishes (3006)
Rice (mixed dishes)	Rice mixed dishes (3202)
Grain (mixed dishes)	Pasta mixed dishes, excludes macaroni and cheese (3204); macaroni and cheese (3206); turnovers and other grain-based items (3208)
Asian foods	Fried rice and lo/chow mein (3402); stir-fry and soy-based sauce mixtures (3403); egg rolls, dumplings, sushi (3406)
Mexican foods	Burritos and tacos (3502); nachos (3504); other Mexican mixed dishes (3506)
Pizza, sandwiches	Pizza (3602); burgers (3702); frankfurter sandwiches (3703); chicken/turkey sandwiches (3704); egg/breakfast sandwiches (3706); other sandwiches (3708)
Soup	Soups (3802)
Rice	Rice (4002)
Breads	Yeast breads (4202); rolls and buns (4204); bagels and English muffins (4206); tortillas (4208)
Cooked grains/cereal	Oatmeal (4802); grits and other cooked cereals (4804); pasta, noodles, cooked grains (4004)
Other grains	Ready-to-eat cereal, higher sugar (4602); ready-to-eat cereal, lower sugar (4604); biscuits, muffins, quick breads (4402); pancakes, waffles, French toast (4404)
Savory snacks	Potato chips (5002); tortilla, corn, other chips (5004); popcorn (5006); pretzels/snack mix (5008)
Fruit	Apples (6002); bananas (6004); grapes (6006); peaches and nectarines (6008); berries (6010); citrus fruits (6012); melons (6014); dried fruits (6016); other fruits and fruit salads (6018)
Red vegetables <sup>a</sup>	Tomatoes (5402); carrots (6404); other red and orange vegetables (6406)
Lettuce, dark green vegetables <sup>a</sup>	Dark green vegetables, excludes lettuce (6408); lettuce and lettuce salads (6410)
Corn, other starchy vegetables	Corn (6416); other starchy vegetables (6418)
Other/mixed vegetables	String beans (6412); onions (6414); other vegetables and combinations (6420); vegetable mixed dishes (6422)
White potatoes	White potatoes, baked or boiled (6802); French fries and other fried white potatoes (6804); mashed potatoes and white potato mixtures (6806)

Soft drinks	Diet soft drinks (7102); diet sport and energy drinks (7104); other diet drinks (7106); soft drinks (7202); fruit drinks (7204); sport and energy drinks (7206); nutritional beverages (7208)
Coffee/tea	Coffee (7302); tea (7304)
Beer	Beer (7502)
Wine	Wine (7504)
Liquor	Liquor and cocktails (7506)
Vegetable oils <sup>a</sup>	Salad dressings and vegetable oils (8012)
Sugars/jam	Sugars and honey (8802); sugar substitutes (8804); jams, syrups, toppings (8806)
Miscellaneous <sup>b</sup>	Eggs and omelets (2502); crackers, excludes saltines (5202); saltine crackers (5204); cereal bars (5402); nutrition bars (5404); cakes and pies (5502); cookies and brownies (5504); doughnuts, sweet rolls, pastries (5506); candy containing chocolate (5702); candy not containing chocolate (5704); ice cream and frozen dairy desserts (5802); pudding (5804); gelatins, ices, sorbets (5806); citrus juice (7002); apple juice (7004); other fruit juice (7006); vegetable juice (7008); tap water (7702); bottled water (7704); flavored or carbonated water (7802); enhanced or fortified water (7804); butter and animal fats (8002); margarine (8004); cream cheese, sour cream, whipped cream (8006); mayonnaise (8010); tomato-based condiments (8402); soy-based condiments (8404); mustard and other condiments (8406); olives, pickles, pickled vegetables (8408); pasta sauces, tomato-based (8410); dips, gravies, other sauces (8412); baby food: cereals (9002); baby food: fruit (9004); baby food: vegetable (9006); baby food: meat and dinners (9008); baby food: yogurt (9010); baby food: snacks and sweets (9012); baby juice (9202); baby water (9204); formula, ready-to-feed (9402); formula, prepared from powder (9404); formula, prepared from concentrate (9406); human milk (9602); protein and nutritional powders (9802); not included in a food category (9999)

USDA = United States Department of Agriculture; WWEIA = What We Eat In America

- a. Data on these categories is presented separately in descriptive statistics; but due to high correlation between these groups they were combined into a single group for regression analysis.
- b. These USDA/WWEIA categories were not included in data analyses

**Supplemental Table 2. Percent and estimated # of people in the United States population with elevated Hg concentrations**

Variable	Seafood consumers		Non-seafood consumers	
	Estimated N	Percent (95% CI)	Estimated N	Percent (95% CI)
THg				
>5.8 µg/L	7,658,023	3.84 (2.33, 6.28)	66,173	0.11 (0.01, 0.88)
>3.4 µg/L	18,734,376	9.40 (6.40, 13.61)	371,944	0.61 (0.23, 1.61)
MeHg				
>5.8 µg/L	7,432,713	3.73 (2.22, 6.19)	66,173	0.11 (0.01, 0.88)
>3.4 µg/L	18,630,708	9.35 (6.43, 13.41)	436,574	0.71 (0.30, 1.69)

THg = whole blood total mercury; MeHg = whole blood methylmercury; CI = confidence interval. Percents and N's are weighted to be estimates of the total US population. Percents are column percents. Estimated N is based on the percentage point estimate. Total estimated number of seafood consumers = 199,254,848; total estimated number of non-seafood consumers= 61,292,885.

**Supplemental Table 3: Mercury concentrations by 24-hr dietary recall, among seafood consumers**

Food type	THg		MeHg		UHg	
	N	GM (95% CI)	N	GM (95% CI)	N	GM (95% CI)
All seafood consumers	5427	0.89 (0.78, 1.02)	5427	0.67 (0.57, 0.80)	1612	4.07 (3.66, 4.52)
Fish	556	1.77 (1.39, 2.26)**	556	1.52 (1.14, 2.03)**	163	5.54 (4.36, 7.04)**
Shellfish	259	1.19 (0.98, 1.45)**	259	0.96 (0.78, 1.20)**	78	4.20 (2.44, 7.21)
Seafood (mixed dishes)	256	1.57 (1.19, 2.08)**	256	1.39 (1.05, 1.85)**	77	5.88 (4.37, 7.92)**
Milk, flavored milk, milkshakes	2659	0.84 (0.72, 0.98)**	2659	0.63 (0.52, 0.76)**	738	4.38 (3.70, 5.17)
Cheese, yogurt	1943	0.92 (0.78, 1.09)	1943	0.70 (0.57, 0.87)	585	4.21 (3.80, 4.65)
Beef, poultry, meats	3455	0.89 (0.80, 0.99)	3455	0.67 (0.57, 0.77)	1045	3.88 (3.38, 4.45)
Meat (mixed dishes)	513	0.78 (0.67, 0.91)**	513	0.58 (0.47, 0.71)**	160	3.21 (2.48, 4.15)**
Poultry (mixed dishes)	378	1.11 (0.91, 1.34)**	378	0.86 (0.67, 1.11)**	114	4.98 (3.78, 6.56)*
Beans, nuts, soy	1435	1.09 (0.92, 1.29)**	1435	0.85 (0.69, 1.06)**	435	5.04 (4.34, 5.86)**
Asian foods	510	1.23 (0.99, 1.52)**	510	1.01 (0.78, 1.30)**	148	4.74 (3.74, 6.00)
Mexican foods	631	0.69 (0.59, 0.80)**	631	0.49 (0.39, 0.61)**	180	3.97 (3.50, 4.49)
Pizza, sandwich	1472	0.71 (0.63, 0.80)**	1472	0.53 (0.46, 0.60)**	433	3.49 (3.01, 4.04)**
Soup	826	1.11 (0.91, 1.36)**	826	0.88 (0.70, 1.11)**	238	4.50 (3.55, 5.70)
Rice	908	1.35 (1.15, 1.59)**	908	1.12 (0.93, 1.36)**	271	4.48 (3.67, 5.47)
Rice (mixed dishes)	430	1.06 (0.85, 1.33)**	430	0.84 (0.64, 1.10)**	124	4.57 (3.52, 5.94)
Grain (mixed dishes)	892	0.82 (0.70, 0.96)*	892	0.61 (0.49, 0.74)*	223	3.76 (3.00, 4.70)
Breads	3114	0.91 (0.80, 1.03)	3114	0.68 (0.58, 0.81)	937	4.32 (3.88, 4.81)**
Cooked grains or cereal	603	1.08 (0.84, 1.39)**	603	0.86 (0.63, 1.17)**	179	5.50 (4.19, 7.21)**
Other grains	1966	0.81 (0.70, 0.95)**	1966	0.60 (0.50, 0.73)**	491	3.92 (3.05, 5.04)
Savory snacks	1881	0.81 (0.70, 0.93)**	1881	0.61 (0.51, 0.73)**	565	4.03 (3.41, 4.77)
Fruit	2401	1.05 (0.90, 1.24)**	2401	0.81 (0.67, 1.00)**	694	4.65 (4.02, 5.37)**
Red or orange vegetables	1231	1.10 (0.92, 1.33)**	1231	0.86 (0.68, 1.09)**	389	4.52 (3.84, 5.33)
Lettuce, dark green vegetables	1464	1.13 (0.92, 1.39)**	1464	0.90 (0.70, 1.15)**	474	4.41 (3.69, 5.28)
Corn, other starchy vegetables	448	0.99 (0.82, 1.20)	448	0.76 (0.61, 0.95)	143	4.63 (3.55, 6.04)
Other/mixed vegetables	1658	1.14 (0.94, 1.39)	1658	0.91 (0.73, 1.15)	512	4.42 (3.72, 5.25)*
White potatoes	1462	0.79 (0.71, 0.88)**	1462	0.58 (0.50, 0.68)**	445	3.71 (3.28, 4.18)**
Sugars, jams	2078	0.98 (0.84, 1.14)	2078	0.76 (0.62, 0.92)	623	4.47 (3.69, 5.40)*
Vegetable oils	801	1.14 (0.89, 1.46)**	801	0.90 (0.68, 1.21)**	266	4.58 (3.65, 5.74)
Soft drinks	3288	0.77 (0.68, 0.86)**	3288	0.56 (0.47, 0.65)**	974	3.78 (3.41, 4.18)**
Coffee/tea	2820	1.06 (0.93, 1.22)**	2820	0.82 (0.69, 0.98)**	880	4.51 (3.90, 5.21)**
Beer	491	0.99 (0.87, 1.14)*	491	0.78 (0.65, 0.94)*	174	3.65 (3.10, 4.31)
Wine	310	1.87 (1.49, 2.34)**	310	1.63 (1.26, 2.11)**	98	5.91 (4.74, 7.38)**
Liquor	270	1.27 (0.99, 1.62)**	270	1.01 (0.76, 1.35)**	86	4.34 (3.11, 6.05)

THg = whole blood total mercury; MeHg = whole blood methylmercury; UHg urinary total mercury; GM = geometric mean; 95% CI = 95% confidence interval. THg, MeHg are in µg/dL; UHg is in µg/g creatinine. \*p<0.10; \*\* p<0.05 for Wald test comparing those who ate the food vs. not in the past 24 hours.

**Supplemental Table 4: Mercury concentrations by 24-hr dietary recall, among non-seafood consumers**

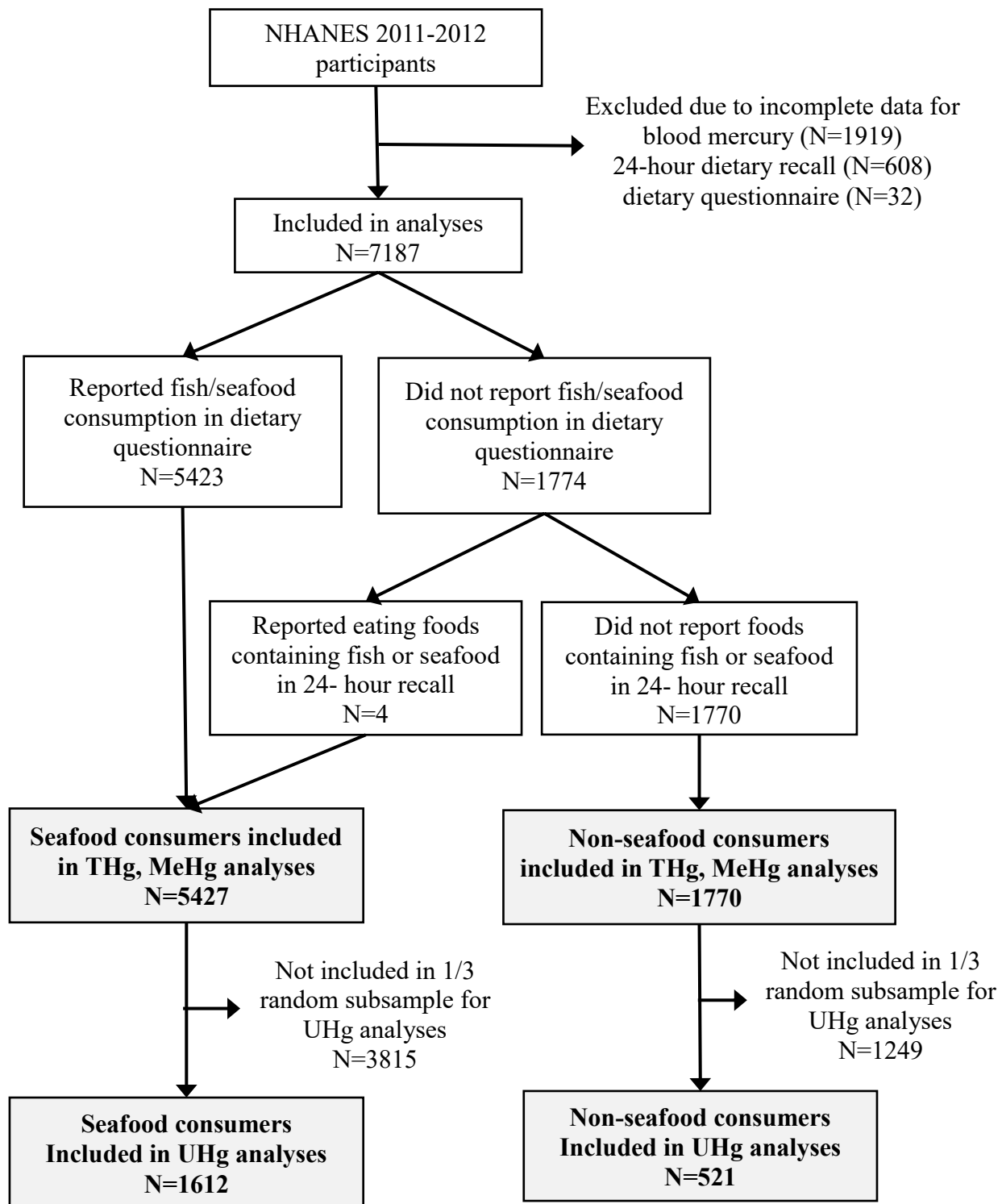
Food type	THg		MeHg		UHg	
	N	GM (95% CI)	N	GM (95% CI)	N	GM (95% CI)
All non-seafood consumers	1770	0.31 (0.28, 0.34)	1770	0.17 (0.16, 0.19)	521	2.59 (2.17, 3.08)
Milk, flavored milk, milkshakes	976	0.28 (0.25, 0.32)**	976	0.15 (0.14, 0.16)**	260	2.74 (2.38, 3.14)
Cheese, yogurt	667	0.30 (0.26, 0.35)	667	0.17 (0.15, 0.18)	182	2.33 (1.83, 2.98)
Beef, poultry, meats	1102	0.32 (0.28, 0.36)	1102	0.18 (0.17, 0.20)*	311	2.26 (1.81, 2.81)**
Meat (mixed dishes)	147	0.32 (0.28, 0.36)	147	0.18 (0.15, 0.21)	43	2.53 (1.81, 3.53)
Poultry (mixed dishes)	95	0.34 (0.25, 0.46)	95	0.17 (0.13, 0.22)	30	2.79 (1.68, 4.62)
Beans, nuts, soy	399	0.33 (0.28, 0.39)	399	0.18 (0.15, 0.21)	109	2.64 (2.14, 3.25)
Asian foods	74	0.36 (0.27, 0.48)	74	0.23 (0.16, 0.32)	17	2.38 (1.51, 3.76)
Mexican foods	244	0.31 (0.26, 0.36)	244	0.17 (0.14, 0.20)	68	2.78 (2.10, 3.66)
Pizza, sandwich	563	0.29 (0.25, 0.35)	563	0.16 (0.14, 0.19)	167	2.77 (1.80, 4.28)
Soup	202	0.34 (0.26, 0.43)	202	0.21 (0.17, 0.26)*	56	2.73 (2.08, 3.58)
Rice	201	0.38 (0.28, 0.51)	201	0.23 (0.16, 0.34)*	61	3.10 (2.32, 4.14)
Rice (mixed dishes)	122	0.40 (0.32, 0.49)**	122	0.21 (0.16, 0.27)	27	4.78 (2.75, 8.31)**
Grain (mixed dishes)	331	0.29 (0.26, 0.32)	331	0.16 (0.14, 0.18)	98	2.34 (1.91, 2.86)
Breads	995	0.31 (0.28, 0.34)	995	0.17 (0.15, 0.18)	299	2.57 (2.18, 3.03)
Cooked grains or cereal	149	0.29 (0.24, 0.35)	149	0.16 (0.13, 0.20)	35	3.26 (1.98, 5.36)
Other grains	712	0.28 (0.26, 0.31)**	712	0.16 (0.15, 0.17)**	171	2.97 (2.47, 3.58)
Savory snacks	675	0.30 (0.26, 0.36)	675	0.16 (0.15, 0.18)**	210	2.54 (2.02, 3.19)
Any fruit	644	0.30 (0.27, 0.33)	644	0.17 (0.16, 0.19)	170	2.87(2.43, 3.38)
Red or orange vegetables	274	0.37 (0.32, 0.43)**	274	0.20 (0.18, 0.23)**	85	2.76 (1.96, 3.88)
Lettuce, dark green vegetables	336	0.38 (0.33, 0.44)**	336	0.22 (0.19, 0.24)**	102	2.67 (1.88, 3.80)
Corn, other starchy vegetables	112	0.37 (0.29, 0.46)	112	0.20 (0.14, 0.27)	31	2.25 (1.63, 3.09)
Other/mixed vegetables	366	0.35 (0.29, 0.41)*	366	0.21 (0.18, 0.24)**	126	2.35 (1.63, 3.39)
White potatoes	512	0.30 (0.27, 0.35)	512	0.17 (0.15, 0.19)	167	2.13 (1.52, 2.97)
Sugars, jam	571	0.32 (0.29, 0.35)	571	0.18 (0.17, 0.20)	176	2.21 (2.00, 2.45)*
Vegetable oils	171	0.33 (0.26, 0.44)	171	0.18 (0.15, 0.23)	266	4.58 (3.65, 5.74)
Soft drinks	1168	0.31 (0.27, 0.35)	1168	0.17 (0.16, 0.19)	634	2.61 (2.10, 3.26)
Coffee/tea	666	0.35 (0.32, 0.37)**	666	0.19 (0.18, 0.21)**	235	2.39 (1.95, 2.94)
Beer	103	0.43 (0.36, 0.52)**	103	0.25 (0.19, 0.33)**	29	2.43 (1.53, 3.87)
Wine	21	0.62 (0.35, 1.10)**	21	0.50 (0.27, 0.92)**	8	NS
Liquor	39	0.49 (0.34, 0.70)**	39	0.30 (0.19, 0.47)**	9	NS

THg = whole blood total mercury; MeHg = whole blood methylmercury; UHg urinary total mercury; GM = geometric mean; 95% CI = 95% confidence interval. THg, MeHg are in µg/dL; UHg is in µg/g creatinine. \*p<0.10; \*\* p<0.05 for Wald test comparing those who ate the food vs. not in the past 24 hours. NS = Not shown because N<10.

**Supplemental Table 5. Difference in R<sup>2</sup> attributable to individual food categories**

Variable	THg-SF	THg-nonSF	MeHg-SF	MeHg-nonSF	UHg-SF	UHg-nonSF
Fish, shellfish or mixed seafood	0.0279	--	0.0276	--	0.0086	--
Beans, nuts or soy	0.0029	0.0001	0.0001	0.0000	0.0084	0.0001
Asian foods	0.0020	0.0005	0.0005	0.0006	0.0012	0.0006
Soup	0.0030	0.0001	0.0028	0.0020	0.0006	0.0000
Mixed rice dishes	0.0013	0.0022	0.0037	0.0000	0.0005	0.0171
Rice	0.0018	0.0022	0.0015	0.0032	0.0001	0.0025
Red or leafy vegetables or oil	0.0072	0.0072	0.0059	0.0014	0.0018	0.0011
Beer	0.0000	0.0016	0.0061	0.0004	0.0000	0.0000
Wine	0.0174	0.0069	0.0112	0.0545	0.0016	0.0050
Liquor	0.0020	0.0047	0.0003	0.0149	0.0005	0.0026

Values in the table are the difference in regression model R<sup>2</sup> comparing the fully adjusted model (shown in Tables 3-5) minus the R<sup>2</sup> from a model which does not have one of the individual food categories included; thus the difference in R<sup>2</sup> reflects the amount of variability that is explained by each individual food category. THg=whole blood total mercury; MeHg=whole blood methyl mercury; UHg=Urinary mercury; SF= seafood consumer; non-SF=non-seafood consumer. Models adjust for age, sex, education and race/ethnicity in addition to the foods listed in the table above.



**Supplemental Figure 1:** Flowchart depicting inclusion of participants in analyses.